

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/06685 A1(51) International Patent Classification⁷: H04B 17/00

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(21) International Application Number: PCT/GB00/02763

(22) International Filing Date: 18 July 2000 (18.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9916904.7 19 July 1999 (19.07.1999) GB(71) Applicant (for all designated States except US): CAM-
BRIDGE SILICON RADIO LTD [GB/GB]; Unit 300,
Science Park, Milton Road, Cambridge CB4 0XL (GB).

(72) Inventor; and

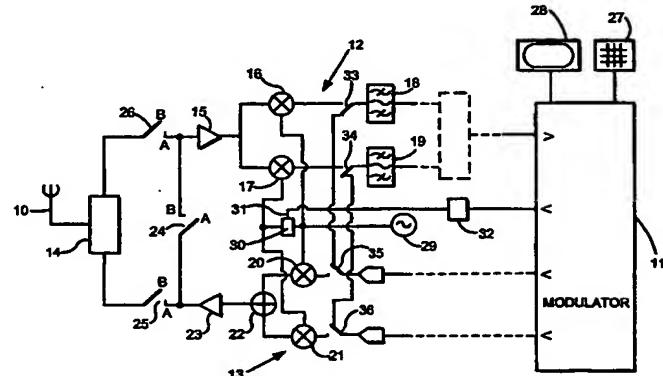
(75) Inventor/Applicant (for US only): COLLIER, James,
Digby, Yarlet [GB/GB]; Church Farm, Chettisham, Ely,
Cambridgeshire CB6 1SB (GB).(74) Agents: SLINGSBY, Philip, Roy et al.; Page White &
Farrer, 54 Doughty Street, London WC1N 2LS (GB).(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: TESTING RESPONSE OF A RADIO TRANSCEIVER



WO 01/06685 A1

(57) Abstract: A radio transceiver comprising: an antenna; a local oscillator for generating a local oscillator signal at a local oscillator frequency; a receiver capable of receiving a first radio frequency signal from the antenna at a receiver input and having a first mixer for mixing a signal derived from the first radio signal with the said local oscillator signal to generate an intermediate frequency signal, and a receiver output for providing an output signal dependant on the intermediate frequency signal; a transmitter capable of receiving an input signal at a transmitter input and having a second mixer for mixing a signal derived from the input signal with a local oscillator signal to generate a second radio frequency signal for transmission; a switching arrangement having a normal configuration in which the transmitter is coupled to the antenna to apply the second radio frequency signal to the antenna, and a testing configuration in which the transmitter is coupled to the receiver input to apply the second radio frequency signal to the receiver input; and a signal processor coupled to the transmitter input and the receiver output and capable of, when the switching arrangement is in the testing configuration, applying a testing signal to the transmitter input to cause the transmitter to generate a radio frequency test signal, and determining from the output signal of the receiver the response of the receiver to the radio frequency test signal.

TESTING RESPONSE OF A RADIO TRANSCEIVER

This invention relates to testing the response of circuits, especially but not exclusively in radio transceivers.

Figure 1 shows a schematic diagram of a complex (IQ) part of a radio receiver. A received radio frequency (RF) signal is received at 1 and amplified by amplifier 2. The output of the amplifier at 3 is split to mixers 4 and 5. Mixer 4 generates an in-phase (I) demodulated signal at 6 by mixing the signal at 3 with a signal LO_I of local oscillator frequency f_{LO} . Mixer 4 generates a quadrature (Q) demodulated signal at 6 by mixing the signal at 3 with a signal LO_Q which also has frequency f_{LO} but is orthogonal to signal LO_I - that is signal LO_Q is out of phase by 90° with respect to signal LO_I .

In practice, it is difficult to ensure that signals LO_I and LO_Q are precisely orthogonal, or that the gains or group delays of mixers 3 and 4 and filters 8 and 9 are precisely equal. The result of this is that image responses are introduced. No realisable receiver has infinite image rejection. Instead of trying to avoid image frequencies altogether, most receiver specifications set a lower limit on the image rejection that is to be achieved. To check that a particular receiver meets the specification it must be tested after having been manufactured. This generally requires specific testing equipment in the production line and calls for extra time in the production line to allow the testing to take place.

In the manufacturing process receivers can be adjusted to optimise their image rejection. However, this takes further time, and does not address the fact that the image rejection performance of the receiver in actual use may be different from that measured during manufacture, for example due to temperature changes.

According to the present invention there is provided a radio transceiver comprising: an antenna; a local oscillator for generating a local oscillator signal at

a local oscillator frequency; a receiver capable of receiving a first radio frequency signal from the antenna at a receiver input and having a first mixer for mixing a signal derived from the first radio signal with the said local oscillator signal to generate an intermediate frequency signal, and a receiver output for providing an output signal dependant on the intermediate frequency signal; a transmitter capable of receiving an input signal at a transmitter input and having a second mixer for mixing a signal derived from the input signal with a local oscillator signal to generate a second radio frequency signal for transmission; a switching arrangement having a normal configuration in which the transmitter is coupled to the antenna to apply the second radio frequency signal to the antenna, and a testing configuration in which the transmitter is coupled to the receiver input to apply the second radio frequency signal to the receiver input; and a signal processor coupled to the transmitter input and the receiver output and capable of, when the switching arrangement is in the testing configuration, applying a testing signal to the transmitter input to cause the transmitter to generate a test signal at a frequency of the difference between the local oscillator frequency and the intermediate frequency, and determining from the output signal of the receiver the response of the receiver to the test signal.

The present invention also provides a method of testing a radio transceiver comprising an antenna; a local oscillator for generating a local oscillator signal at a local oscillator frequency; a receiver capable of receiving a first radio frequency signal from the antenna at a receiver input and having a first mixer for mixing a signal derived from the second radio signal with the said local oscillator signal to generate an intermediate frequency signal, and a receiver output for providing an output signal dependant on the intermediate frequency signal; a transmitter capable of receiving an input signal at a transmitter input and having a second mixer for mixing a signal derived from the input signal with a local oscillator signal to generate a second radio frequency signal for transmission; a switching arrangement having a normal configuration in which the transmitter is coupled to the antenna to apply the second radio frequency signal to the antenna, and a testing configuration in which the transmitter is coupled to the receiver input to

apply the second radio frequency signal to the receiver input; the method comprising: setting the switching arrangement to the testing configuration; applying a testing signal to the transmitter input to cause the transmitter to generate a radio frequency test signal; and detecting the output signal of the receiver to determine the response of the receiver to the radio frequency test signal.

The receiver may have in-phase and quadrature channels. The in-phase and quadrature channels may each include mixers (one of which is the said first mixer) for mixing with a signal from the local oscillator at the local oscillator frequency. One of those mixers suitably mixes with an in-phase signal and the other suitably mixes with a quadrature signal. The local oscillator preferably includes a phase shifter for generating one of the in-phase and quadrature signals from the other (although the signals could be generated separately in the local oscillator). The local oscillator is preferably adjustable by the signal processor, most preferably to alter the phase difference between the in-phase and quadrature signals. Thus the phase shifter of the oscillator (where present) is most preferably adjustable by the signal processor.

The test signal is preferably at a frequency at which it is undesired for the transceiver to receive signals – for example an image frequency of the transceiver. The signal processor is preferably capable of adjusting the local oscillator (most preferably the phase difference between the local oscillator's in-phase and quadrature signals) and/or the gain(s) of the mixer(s) of the receiver to reduce, and most preferably minimise, the response of the receiver to the test signal, that is suitably to increase/maximise the image rejection of the receiver. The said reduction/minimisation is preferably performed in response to the signal received by the signal processor from the receiver.

Preferably the said mixer(s) of the receiver and the mixer(s) of the transmitter receive their local oscillator signals from the same local oscillator.

The signal processor may be provided as a single integrated circuit, as more than one integrated circuit or as a circuit of discrete components. The signal processor may include a digital synthesiser for generating the testing signal and/or a modulator for generating the testing signal. The testing signal is suitably a modulated signal. The testing signal is preferably at the negative of the said intermediate frequency of the receiver.

The radio transceiver may have a second switching arrangement having a normal configuration in which the testing signal is coupled to the second mixer and a testing configuration in which the testing signal is coupled to an intermediate frequency section of the receiver. In that case the signal processor may be capable of, when the second switching arrangement is in the testing configuration, generating a testing signal, and determining from the output signal of the receiver the response of at least the intermediate frequency section of the receiver to the test signal.

The transceiver is preferably capable of switching automatically between the normal configuration and the testing configuration. The transceiver may suitably be configured to switch automatically to the testing configuration on enabling of the receiver and/or the transceiver, and/or in response to a signal that may be applied to the transceiver during manufacture or testing.

In a further aspect of the invention the test signal may be at an intermediate frequency and may be applied directly to an intermediate frequency section of the receiver.

The present invention will now be described by way of example, with reference to the accompanying drawings, in which:

figure 1 shows a prior art receiver circuit; and

figure 2 shows a schematic diagram of part of a radio receiver circuit according to the present invention.

Figure 2 shows part of a radio transceiver circuit. The circuit has an antenna 10 and a signal processing unit 11 for baseband or intermediate frequency processing of received signals and signals that are to be transmitted. Between the antenna and the signal processing unit are a receive chain 12 and a transmit chain 13, which are connected to the antenna 10 by a duplexer 14. The receive chain 12 converts received radio frequency (RF) signals down to baseband for further processing by the signal processing unit 11, and the transmit chain 13 converts signals up from baseband to RF for transmission from the antenna 10.

The receive chain is shown in partial detail, and comprises an input amplifier 15 which amplifies the received signal. The output of the amplifier 15 is split to mixers 16 and 17 where it is mixed with orthogonal local oscillator signals as described above to generate I and Q signals for further decoding. Band pass filters 18 and 19 filter the I and Q signals respectively.

The transmit chain is also shown in partial detail. In the transmit chain I and Q signals deriving from the signal processing unit 11 that are to be transmitted by the transceiver are mixed with orthogonal local oscillator signals in mixers 20 and 21 and then summed in summation unit 22. The sum signal is then amplified by amplifier 23 and passed to the duplexer 14 and then the antenna 10 for transmission.

In this transceiver there is provision in the form of switch 24 for the input of amplifier 15 to be connected to the output of the summation unit 22. At the same time the output of the summation unit 22 can be disconnected by switch 25 from the input of the amplifier 15 and the input of amplifier 15 can be disconnected by switch 26 from the duplexer 14, although the effects of those connections could be neutralised in other ways. In one mode (settings A in figure 2) the switches 24-26 can be set to allow the transceiver to operate as normal. In the other mode(settings B in figure 2) the switches 24-26 can be set to allow the transceiver to operate in a self-test mode whereby the image rejection performance of the receiver can be checked. The switches could be mechanical or electronic

switches (e.g. transistors). The switches 24-26 could be operable under the control of the signal processing unit 11 in order to allow the self-test procedure to be performed fully automatically.

The self-test procedure could be actuated by entering a command using the keypad 27 of the transceiver, or in another way - for example by the actuation of a dedicated switch of the transceiver, automatically on turn-on of the transceiver or by a command transmitted to the signal processor 11 by radio. Upon actuation of the self-test mode the receiver limb of the transceiver is actuated and tuned to a frequency $f_{LO}+f_{IF}$, where f_{LO} is the local oscillator frequency and f_{IF} is the receiver's intermediate frequency. Due to imperfection of the receiver there will be a weaker image response at frequency $f_{LO}-f_{IF}$. In the transmit limb of the transceiver the modulator of the signal processor 11 is set to generate a signal at a negative frequency $-f_{IF}$ at baseband. That signal is mixed up to radio frequency by the complex mixer 20, 21 to produce a signal at frequency $f_{LO}-f_{IF}$. Due to imperfection of the transmitter there will also be an image frequency at $f_{LO}+f_{IF}$. The switches 24-26 are set to settings B so that the output of the transmit chain (at $f_{LO}-f_{IF}$ and $f_{LO}+f_{IF}$) is passed to the RF input of the receive section. f_{LO} can be set anywhere in the normal local oscillator frequency range - suitably around mid-band. The receiver generates an output in the normal way. The output is thus responsive to the principal signal from the transmit chain (at frequency $f_{LO}-f_{IF}$) and the image signal from the transmit chain (at frequency $f_{LO}+f_{IF}$) provided it is on-channel for the receiver.

The output from the receiver is detected and measured in the normal way by the signal processor 11, and the strength of the image frequency relative to the principal frequency is determined. This gives a measure of the transceiver's image rejection. This result can be displayed on a display 28 of the transceiver or transmitted by radio to another unit, for example a manufacturing test unit. The transceiver can thus make the measurement of image rejection during manufacture a fully automated process requiring no additional testing equipment. This makes in-line self testing highly convenient.

The transceiver generates the I and Q local oscillator signals by means of an oscillator 29 operating at the selected local oscillator frequency f_{LO} , the output of which represents the local oscillator I signal and is phase shifted by phase shifter 30 to form the Q signal. The amount of phase shift imposed by the phase shifter is finely adjustable by an analogue signal to its tuning input 31. The analogue signal is derived from an analogue-to-digital converter 32 responsive to the signal processor 11. The generation of the I and Q signals could be done in other ways, for example with the aid of a servo amplifier.

The signal processor 11 can act to improve the image rejection performance of the receiver. It can enter a mode (for example after manufacture, at turn-on or periodically during use) in which it measures the image rejection performance of the receiver as described above and then adjusts the phase shifter 30 to optimise image rejection.

In order for the above process to work the receiver's intermediate frequency must be within the modulation range of the transmitter section of the transceiver. This is likely to be straightforward for near-zero IF receivers, which are becoming increasingly common.

It is possible also to provide a links between the IF part of the transmitter and the IF part of the receiver (e.g. using switches 33-36). An additional step may then be introduced to further optimise the receiver. The switches 33-36 may be set to connect the IF part of the transmitter to that of the receiver. Then the signal processor generates a baseband signal at $-f_{IF}$ which is applied directly to the IF input of the receiver. If the filters (e.g. IF complex channel filters) of the receiver are tuneable by the signal processor 11 then by monitoring the output of the receiver circuit during this process the signal processor can set up the IF section optimally before optimising the RF section.

Another testing procedure can be performed by setting the switches 33-36 to their testing settings and the signal processor 11 generating a range of frequencies around $+f_{IF}$. This allows the signal processor to monitor the on-channel response of the receiver and may be especially useful for built-in self-testing.(BIST).

The applicant draws attention to the fact that the present invention may include any feature or combination of features disclosed herein either implicitly or explicitly or any generalisation thereof, without limitation to the scope of any of the present claims. In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.

CLAIMS

1. A radio transceiver comprising:
 - an antenna;
 - a local oscillator for generating a local oscillator signal at a local oscillator frequency;
 - a receiver capable of receiving a first radio frequency signal from the antenna at a receiver input and having a first mixer for mixing a signal derived from the first radio signal with the said local oscillator signal to generate an intermediate frequency signal, and a receiver output for providing an output signal dependant on the intermediate frequency signal;
 - a transmitter capable of receiving an input signal at a transmitter input and having a second mixer for mixing a signal derived from the input signal with a local oscillator signal to generate a second radio frequency signal for transmission;
 - a switching arrangement having a normal configuration in which the transmitter is coupled to the antenna to apply the second radio frequency signal to the antenna, and a testing configuration in which the transmitter is coupled to the receiver input to apply the second radio frequency signal to the receiver input; and
 - a signal processor coupled to the transmitter input and the receiver output and capable of, when the switching arrangement is in the testing configuration, applying a testing signal to the transmitter input to cause the transmitter to generate a radio frequency test signal, and determining from the output signal of the receiver the response of the receiver to the radio frequency test signal.
2. A radio transceiver as claimed in claim 1, wherein the local oscillator is capable of generating an in-phase signal and a quadrature signal, the first mixer is arranged to mix the said signal derived from the first radio signal with the in-phase signal, and the receiver comprises a third mixer arranged to mix the said signal derived from the first radio signal with the quadrature signal.

3. A radio transceiver as claimed in claim 2, wherein the local oscillator is adjustable by the signal processor to vary the phase difference between the in-phase and quadrature signals.
4. A radio transceiver as claimed in claim 2, wherein the local oscillator is adjustable by the signal processor to vary the phase difference between the in-phase and quadrature signals so as to reduce the response of the receiver to the test signal.
5. A radio transceiver as claimed in any of claims 2 to 4, wherein the gain of at least one of the first and third mixers is adjustable by the signal processor so as to reduce the response of the receiver to the test signal.
6. A radio transceiver as claimed in claim 4 or 5, wherein the switching arrangement is operable by the signal processor, and the signal processor has a testing mode in which it is capable of: setting the switching arrangement to the testing configuration, determining from the output signal of the receiver the response of the receiver to the radio frequency test signal, and adjusting the local oscillator and/or at least one of the first and third mixers to reduce the response of the receiver to the test signal.
7. A radio transceiver as claimed in any preceding claim, wherein the receiver comprises at least two intermediate frequency stages.
8. A radio transceiver as claimed in any preceding claim, wherein the local oscillator signal applied to the second mixer is generated by the said local oscillator.
9. A radio transceiver as claimed in any preceding claim, wherein the signal processor includes a digital synthesiser for generating the test signal.

10. A radio transceiver as claimed in any preceding claim, wherein the signal processor includes a modulator for generating the test signal.

11. A radio transceiver as claimed in any preceding claim, wherein the testing signal is at the negative of the intermediate frequency.

12. A radio transceiver as claimed in any preceding claim, including a second switching arrangement having a normal configuration in which the said signal derived from the input signal is coupled to the second mixer and a testing configuration in which the said signal derived from the input signal is coupled to an intermediate frequency section of the receiver as a testing signal.

13. A radio transceiver as claimed in claim 12, wherein the signal processor is capable of, when the second switching arrangement is in the testing configuration, generating the testing signal, and determining from the output signal of the receiver the response of at least the intermediate frequency section of the receiver to the testing signal.

14. A method of testing a radio transceiver comprising an antenna; a local oscillator for generating a local oscillator signal at a local oscillator frequency; a receiver capable of receiving a first radio frequency signal from the antenna at a receiver input and having a first mixer for mixing a signal derived from the first radio signal with the said local oscillator signal to generate an intermediate frequency signal, and a receiver output for providing an output signal dependant on the intermediate frequency signal; a transmitter capable of receiving an input signal at a transmitter input and having a second mixer for mixing a signal derived from the input signal with a local oscillator signal to generate a second radio frequency signal for transmission; a switching arrangement having a normal configuration in which the transmitter is coupled to the antenna to apply the second radio frequency signal to the antenna, and a testing configuration in which the transmitter is coupled to the receiver input to apply the second radio frequency signal to the receiver input; the method comprising:

setting the switching arrangement to the testing configuration;
applying a testing signal to the transmitter input to cause the transmitter to generate a radio frequency test signal ; and
detecting the output signal of the receiver to determine the response of the receiver to the test signal.

15. A radio transceiver substantially as herein described with reference to figure 2 of the accompanying drawings.

16. A method of testing a radio transceiver substantially as herein described with reference to figure 2 of the accompanying drawings.

1 / 1

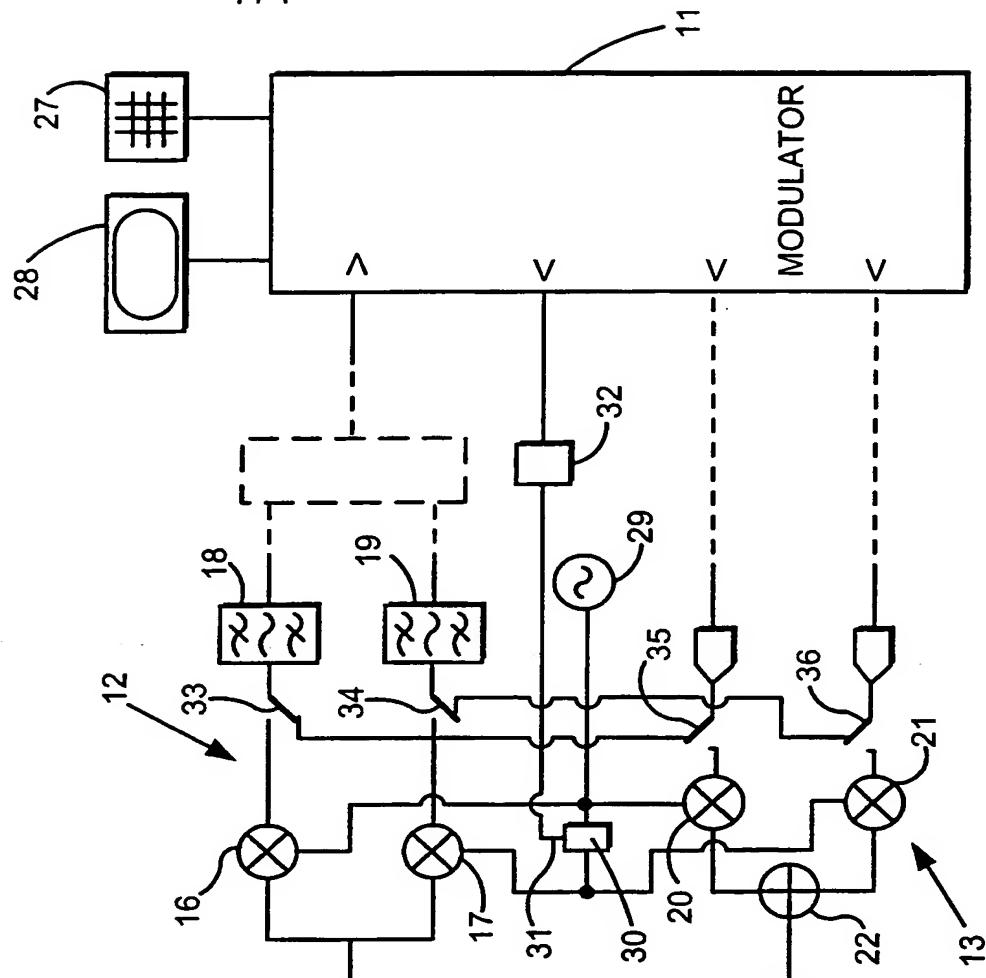


FIG.1

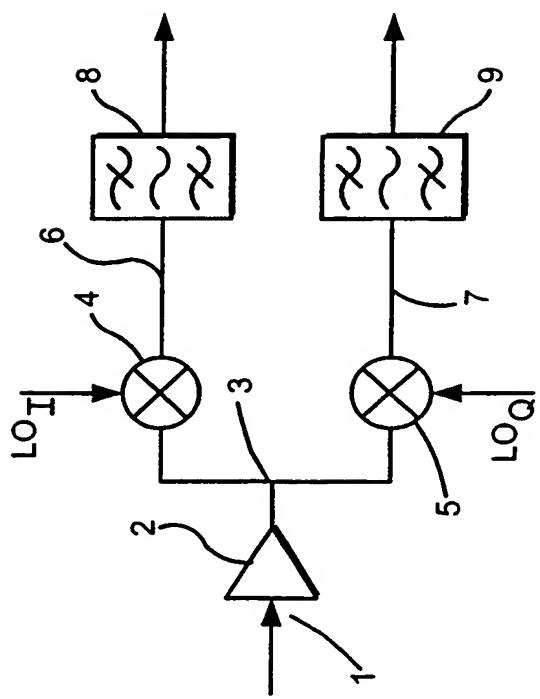


FIG.2

INTERNATIONAL SEARCH REPORT

Int'l Application No
PCT/GB 00/02763

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WO 91 19363 A (TELENOKIA OY) 12 December 1991 (1991-12-12)</p> <p>* abstract *</p> <p>page 1, line 7 -page 2, line 26 page 3, line 1 - line 18 page 4, line 7 -page 5, line 16 page 6, line 34 -page 7, line 8 page 8, line 29 - line 35 figure 2</p> <p>---</p> <p>US 5 594 950 A (D AMICO CHARLES R ET AL) 14 January 1997 (1997-01-14)</p> <p>* abstract *</p> <p>column 1, line 43 -column 3, line 8 column 4, line 14 - line 54</p> <p>---</p> <p>-/-</p>	1-8, 14-16
X		1,14-16

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

18 October 2000

Date of mailing of the international search report

26/10/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

López Márquez, T

INTERNATIONAL SEARCH REPORT

Int'l. Application No.
PCT/GB 00/02763

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 599 679 A (TELECOMMUNICATIONS SA) 1 June 1994 (1994-06-01) column 1, line 7 -column 2, line 15 column 3, line 39 - line 52 column 4, line 23 -column 5, line 12 claim 1; figure 2 -----	1,14-16
A	US 5 109 535 A (KUME TOMIYUKI ET AL) 28 April 1992 (1992-04-28) column 1, line 40 -column 2, line 8 column 3, line 26 -column 4, line 8 figure 3 -----	1,14-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/02763

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9119363	A 12-12-1991	FI 902624	A	15-11-1991
		AT 130481	T	15-12-1995
		AU 647135	B	17-03-1994
		AU 7865491	A	31-12-1991
		DE 69114704	D	21-12-1995
		DE 69114704	T	18-04-1996
		EP 0531333	A	17-03-1993
		NO 179656	B	12-08-1996
US 5594950	A 14-01-1997	NONE		
EP 0599679	A 01-06-1994	FR 2698745	A	03-06-1994
		DE 69316173	D	12-02-1998
		DE 69316173	T	09-07-1998
US 5109535	A 28-04-1992	JP 1314444	A	19-12-1989
		JP 1878180	C	07-10-1994
		JP 6003886	B	12-01-1994

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 102439/PRS	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/02763	International filing date (day/month/year) 18/07/2000	(Earliest) Priority Date (day/month/year) 19/07/1999
Applicant CAMBRIDGE SILICON RADIO LTD		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

contained in the international application in written form.

filed together with the international application in computer readable form.

furnished subsequently to this Authority in written form.

furnished subsequently to this Authority in computer readable form.

the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. **Certain claims were found unsearchable (See Box I).**

3. **Unity of invention is lacking (see Box II).**

4. With regard to the **title**,

the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.

the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

as suggested by the applicant.

because the applicant failed to suggest a figure.

because this figure better characterizes the invention.

2

None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/02763

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04B17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^o	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WO 91 19363 A (TELENOKIA OY) 12 December 1991 (1991-12-12)</p> <p>* abstract *</p> <p>page 1, line 7 -page 2, line 26 page 3, line 1 - line 18 page 4, line 7 -page 5, line 16 page 6, line 34 -page 7, line 8 page 8, line 29 - line 35 figure 2</p> <p>---</p>	1-8, 14-16
X	<p>US 5 594 950 A (D AMICO CHARLES R ET AL) 14 January 1997 (1997-01-14)</p> <p>* abstract *</p> <p>column 1, line 43 -column 3, line 8 column 4, line 14 - line 54</p> <p>---</p> <p>-/-</p>	1,14-16

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

18 October 2000

26/10/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

López Márquez, T

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/02763

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 599 679 A (TELECOMMUNICATIONS SA) 1 June 1994 (1994-06-01) column 1, line 7 -column 2, line 15 column 3, line 39 - line 52 column 4, line 23 -column 5, line 12 claim 1; figure 2 ---	1, 14-16
A	US 5 109 535 A (KUME TOMIYUKI ET AL) 28 April 1992 (1992-04-28) column 1, line 40 -column 2, line 8 column 3, line 26 -column 4, line 8 figure 3 -----	1, 14-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/02763

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
WO 9119363	A 12-12-1991	FI 902624	A	15-11-1991	
		AT 130481	T	15-12-1995	
		AU 647135	B	17-03-1994	
		AU 7865491	A	31-12-1991	
		DE 69114704	D	21-12-1995	
		DE 69114704	T	18-04-1996	
		EP 0531333	A	17-03-1993	
		NO 179656	B	12-08-1996	
US 5594950	A 14-01-1997	NONE			
EP 0599679	A 01-06-1994	FR 2698745	A	03-06-1994	
		DE 69316173	D	12-02-1998	
		DE 69316173	T	09-07-1998	
US 5109535	A 28-04-1992	JP 1314444	A	19-12-1989	
		JP 1878180	C	07-10-1994	
		JP 6003886	B	12-01-1994	

PATENT COOPERATION TREATY

PCT

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

SLINGSBY, Philip, Roy
Page White & Farrer
54 Doughty Street
London WC1N 2LS
ROYAUME-UNI

RECEIVED

2 FEB 2001

Ans'd.....

Date of mailing (day/month/year) 25 January 2001 (25.01.01)			
Applicant's or agent's file reference 102439/PRS		IMPORTANT NOTICE	
International application No. PCT/GB00/02763	International filing date (day/month/year) 18 July 2000 (18.07.00)	Priority date (day/month/year) 19 July 1999 (19.07.99)	
Applicant CAMBRIDGE SILICON RADIO LTD et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU, KP, KR, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
AE, AG, AL, AM, AP, AT, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EA, EE, EP, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OA, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, YU
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 25 January 2001 (25.01.01) under No. WO 01/06685

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference

(if desired) (12 characters maximum)

102439/PRS

Box No. I TITLE OF INVENTION

TESTING RESPONSE OF A RADIO TRANSCEIVER

Box No. II APPLICANT

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

CAMBRIDGE SILICON RADIO LTD
Unit 300
Science Park
Milton Road
Cambridge CB4 0XL
United Kingdom

This person is also inventor.

Telephone No.

Faximile No.

Teleprinter No.

State (that is, country) of nationality:

United Kingdom (GB)

State (that is, country) of residence:

United Kingdom (GB)

This person is applicant all designated all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box for the purposes of:

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

COLLIER; James Digby Yarlet
Church Farm
Chettisham
Ely
Cambridgeshire CB6 1SB
United Kingdom

This person is:

applicant only

applicant and inventor

inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

United Kingdom (GB)

State (that is, country) of residence:

United Kingdom (GB)

This person is applicant all designated all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box for the purposes of:

Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

agent

common representative

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country.)

SLINGSBY; Philip Roy
PAGE WHITE & FARRER
54 Doughty Street
London WC1N 2LS
United Kingdom

Telephone No.

020 7831 7929

Faximile No.

020 7831 8040

Teleprinter No.

8955681

Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes: at least one must be marked):

Regional Patent

AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

<input checked="" type="checkbox"/> AE United Arab Emirates	<input checked="" type="checkbox"/> LC Saint Lucia
<input checked="" type="checkbox"/> AG Antigua and Barbuda	<input checked="" type="checkbox"/> LK Sri Lanka
<input checked="" type="checkbox"/> AL Albania	<input checked="" type="checkbox"/> LR Liberia
<input checked="" type="checkbox"/> AM Armenia	<input checked="" type="checkbox"/> LS Lesotho
<input checked="" type="checkbox"/> AT Austria	<input checked="" type="checkbox"/> LT Lithuania
<input checked="" type="checkbox"/> AU Australia	<input checked="" type="checkbox"/> LU Luxembourg
<input checked="" type="checkbox"/> AZ Azerbaijan	<input checked="" type="checkbox"/> LV Latvia
<input checked="" type="checkbox"/> BA Bosnia and Herzegovina	<input checked="" type="checkbox"/> MA Morocco
<input checked="" type="checkbox"/> BB Barbados	<input checked="" type="checkbox"/> MD Republic of Moldova
<input checked="" type="checkbox"/> BG Bulgaria	<input checked="" type="checkbox"/> MG Madagascar
<input checked="" type="checkbox"/> BR Brazil	<input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia
<input checked="" type="checkbox"/> BY Belarus	<input checked="" type="checkbox"/> MN Mongolia
<input checked="" type="checkbox"/> BZ Belize	<input checked="" type="checkbox"/> MW Malawi
<input checked="" type="checkbox"/> CA Canada	<input checked="" type="checkbox"/> MX Mexico
<input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein	<input checked="" type="checkbox"/> MZ Mozambique
<input checked="" type="checkbox"/> CN China	<input checked="" type="checkbox"/> NO Norway
<input checked="" type="checkbox"/> CR Costa Rica	<input checked="" type="checkbox"/> NZ New Zealand
<input checked="" type="checkbox"/> CU Cuba	<input checked="" type="checkbox"/> PL Poland
<input checked="" type="checkbox"/> CZ Czech Republic	<input checked="" type="checkbox"/> PT Portugal
<input checked="" type="checkbox"/> DE Germany	<input checked="" type="checkbox"/> RO Romania
<input checked="" type="checkbox"/> DK Denmark	<input checked="" type="checkbox"/> RU Russian Federation
<input checked="" type="checkbox"/> DM Dominica	<input checked="" type="checkbox"/> SD Sudan
<input checked="" type="checkbox"/> DZ Algeria	<input checked="" type="checkbox"/> SE Sweden
<input checked="" type="checkbox"/> EE Estonia	<input checked="" type="checkbox"/> SG Singapore
<input checked="" type="checkbox"/> ES Spain	<input checked="" type="checkbox"/> SI Slovenia
<input checked="" type="checkbox"/> FI Finland	<input checked="" type="checkbox"/> SK Slovakia
<input checked="" type="checkbox"/> GB United Kingdom	<input checked="" type="checkbox"/> SL Sierra Leone
<input checked="" type="checkbox"/> GD Grenada	<input checked="" type="checkbox"/> TJ Tajikistan
<input checked="" type="checkbox"/> GE Georgia	<input checked="" type="checkbox"/> TM Turkmenistan
<input checked="" type="checkbox"/> GH Ghana	<input checked="" type="checkbox"/> TR Turkey
<input checked="" type="checkbox"/> GM Gambia	<input checked="" type="checkbox"/> TT Trinidad and Tobago
<input checked="" type="checkbox"/> HR Croatia	<input checked="" type="checkbox"/> TZ United Republic of Tanzania
<input checked="" type="checkbox"/> HU Hungary	<input checked="" type="checkbox"/> UA Ukraine
<input checked="" type="checkbox"/> ID Indonesia	<input checked="" type="checkbox"/> UG Uganda
<input checked="" type="checkbox"/> IL Israel	<input checked="" type="checkbox"/> US United States of America
<input checked="" type="checkbox"/> IN India	<input checked="" type="checkbox"/> UZ Uzbekistan
<input checked="" type="checkbox"/> IS Iceland	<input checked="" type="checkbox"/> VN Viet Nam
<input checked="" type="checkbox"/> JP Japan	<input checked="" type="checkbox"/> YU Yugoslavia
<input checked="" type="checkbox"/> KE Kenya	<input checked="" type="checkbox"/> ZA South Africa
<input checked="" type="checkbox"/> KG Kyrgyzstan	<input checked="" type="checkbox"/> ZW Zimbabwe
<input checked="" type="checkbox"/> KP Democratic People's Republic of Korea	
<input checked="" type="checkbox"/> KR Republic of Korea	
<input checked="" type="checkbox"/> KZ Kazakhstan	

Check-box reserved for designating States which have become party to the PCT after issuance of this sheet:

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

Supplemental Box *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. *If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

- (i) *if more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below:*
- (ii) *if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant:*
- (iii) *if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor:*
- (iv) *if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV:*
- (v) *if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application:*
- (vi) *if, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI:*
- (vii) *if, in Box No. VI, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed.*

2. *If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.*

3. *If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.*

Continuation of Box No. IV
Agents continued

PALMER; Roger (GB)
RICHARDS; David John (GB)
JENKINS; Peter David (GB)
DRIVER; Virginia Rozanne (GB)
DANIELS; Jeffrey Nicholas (GB)
STYLE; Kelda Camilla Karen (GB)
NEOBARD; William John (GB)
SHACKLETON; Nicola (GB)
HILL; Christopher Michael (GB)
RUUSKANEN; Juha-Pekka (FI)

all of: Page White & Farrer
54 Doughty Street
London WC1N 2LS
United Kingdom

Tel: 020 7831 7929

Fax: 020 7831 8040

Telex: 8955681

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application:*	international application: receiving Office
item (1) 19 July 1999 (19.07.99)	9916904.7	GB		
item (2)				
item (3)				

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): (1)

* Where the earlier application is an ARPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):	Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):		
ISA /	Date (day/month/year)	Number	Country (or regional Office)

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:	This international application is accompanied by the item(s) marked below:		
request : 4	1. <input checked="" type="checkbox"/> fee calculation sheet		
description (excluding sequence listing part) : 8	2. <input checked="" type="checkbox"/> separate signed power of attorney		
claims : 4	3. <input type="checkbox"/> copy of general power of attorney; reference number, if any:		
abstract : 1	4. <input type="checkbox"/> statement explaining lack of signature		
drawings : 1	5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s):		
sequence listing part of description : _____	6. <input type="checkbox"/> translation of international application into (language):		
Total number of sheets : 18	7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material		
	8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form		
	9. <input checked="" type="checkbox"/> other (specify): 23/77		

Figure of the drawings which
should accompany the abstract: 2 Language of filing of the
international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

SLINGSBY; Philip Roy - Authorised Representative

For receiving Office use only	
1. Date of actual receipt of the purported international application:	2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy
by the International Bureau:

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		
International application No. PCT/GB00/02763		Applicant's or agent's file reference 102439/PRS/DG
International filing date (day/month/year) 18.07.2000		(Earliest) Priority date (day/month/year) 19.07.1999
Title of invention TESTING RESPONSE OF A RADIO TRANSCEIVER		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) CAMBRIDGE SILICON RADIO LTD UNIT 300 SCIENCE PARK MILTON ROAD CAMBRIDGE CB4 0XL UNITED KINGDOM		Telephone No.:
		Facsimile No.:
		Teleprinter No.:
State (that is, country) of nationality: GB		State (that is, country) of residence: GB
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) COLLIER; JAMES DIGBY YARLET CHURCH FARM CHETTISHAM ELY CAMBRIDGESHIRE CB6 1SB UNITED KINGDOM		
State (that is, country) of nationality: GB		State (that is, country) of residence: GB
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)		
State (that is, country) of nationality:		State (that is, country) of residence:
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.		

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is agent common representativeand has been appointed earlier and represents the applicant(s) also for international preliminary examination. is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked. is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*SLINGSBY, PHILIP ROY
PAGE WHITE & FARRER
54 DOUGHTY STREET
LONDON WC1N 2LS
UNITED KINGDOM

Telephone No.:

0207-831 7929

Facsimile No.:

0207-831 8040

Teleprinter No.:

 Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***1. The applicant wishes the international preliminary examination to start on the basis of:

the international application as originally filed
 the description as originally filed
 as amended under Article 34

the claims as originally filed
 as amended under Article 19 (together with any accompanying statement)
 as amended under Article 34

the drawings as originally filed
 as amended under Article 34

2. The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)** Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English.....

which is the language in which the international application was filed.

which is the language of a translation furnished for the purposes of international search.

which is the language of publication of the international application.

which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATESThe applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

1. translation of international application	:	sheets
2. amendments under Article 34	:	sheets
3. copy (or, where required, translation) of amendments under Article 19	:	sheets
4. copy (or, where required, translation) of statement under Article 19	:	sheets
5. letter	:	sheets
6. other (specify)	:	sheets

For International Preliminary Examining Authority use only

received	not received
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

1. <input checked="" type="checkbox"/> fee calculation sheet	4. <input type="checkbox"/> statement explaining lack of signature
2. <input type="checkbox"/> separate signed power of attorney	5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form
3. <input type="checkbox"/> copy of general power of attorney; reference number, if any:	6. <input type="checkbox"/> other (specify):

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

PHILIP ROY SLINGSBY
Professional Representative

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. The applicant has been informed accordingly.

4. The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION
(PCT Rule 61.2)Date of mailing (day/month/year)
10 April 2001 (10.04.01)To:
Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected OfficeInternational application No.
PCT/GB00/02763Applicant's or agent's file reference
102439/PRSInternational filing date (day/month/year)
18 July 2000 (18.07.00)Priority date (day/month/year)
19 July 1999 (19.07.99)

Applicant

COLLIER, James, Digby, Yarlet

1. The designated Office is hereby notified of its election made:

 in the demand filed with the International Preliminary Examining Authority on:

19 February 2001 (19.02.01)

 in a notice effecting later election filed with the International Bureau on:

2. The election was was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Pascal Piriou

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

REC'D 25 OCT 2001
WIPO PCT

14

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 102439/PRS	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/02763	International filing date (day/month/year) 18/07/2000	Priority date (day/month/year) 19/07/1999
International Patent Classification (IPC) or national classification and IPC H04B17/00		
<p>Applicant CAMBRIDGE SILICON RADIO LTD et al.</p> <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input checked="" type="checkbox"/> Certain observations on the international application 		

Date of submission of the demand 19/02/2001	Date of completion of this report 23.10.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Lauri, L Telephone No. +49 89 2399 7304



INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

International application No. PCT/GB00/02763

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-8 as originally filed

Claims, No.:

1-16 as originally filed

Drawings, sheets:

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02763

the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):
(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-16
	No: Claims
Inventive step (IS)	Yes: Claims 1-16
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-16
	No: Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

CITED DOCUMENTS

D1: WO 91 19363 A (TELENOKIA OY) 12 December 1991 (1991-12-12)

D2: US-A-5 594 950 (D AMICO CHARLES R ET AL) 14 January 1997 (1997-01-14)

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The document D1 is regarded as the closest prior art to the subject-matter of claim 1, and describes a radio transceiver comprising:

- an antenna (12);
- a local oscillator (44) for generating a local oscillator signal at a local oscillator frequency;
- a receiver (22, 23, 24, 25) capable of receiving a first radio frequency signal from the antenna at a receiver input and having a first mixer (23) for mixing a signal derived from the first radio signal with the said local oscillator signal to generate an intermediate frequency signal, and a receiver output (output of 25) for providing an output signal dependant on the intermediate frequency signal;
- a transmitter (27, 28, 29, 30) capable of receiving an input signal at a transmitter input and having a second mixer (28) for mixing a signal derived from the input signal with a local oscillator signal to generate a second radio frequency signal for transmission.

However, the document D1 does not disclose the following features:

- a switching arrangement having a normal configuration in which the transmitter is coupled to the antenna to apply the second radio frequency signal to the antenna, and a testing configuration in which the transmitter is coupled to the receiver input to apply the second radio frequency signal to the receiver input;
- a signal processor coupled to the transmitter input and the receiver output and capable of, when the switching arrangement is in the testing configuration, applying a testing signal to the transmitter input to cause the

transmitter to generate a radio frequency test signal, and determining from the output signal of the receiver the response of the receiver to the radio frequency test signal.

These features are neither described nor are they suggested by the available prior art.

Therefore the present application satisfies the criterion set forth in Article 33(2) and 33(3) PCT, because the subject-matter of claim 1 is novel and inventive over the prior art (Rule 64 PCT).

The same conclusion applies to claim 14, which covers the method corresponding to the apparatus of claim 1.

Re Item VII

Certain defects in the international application

1. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
2. Claim 14 does not meet the requirements of Rule 13.1 (cf Guidelines III-3.1), because it defines a method by the features of an apparatus.
3. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 are not mentioned in the description, nor are these documents identified therein.
4. The reference to the drawings in claim 15 and 16 is not allowed in accordance with Rule 6.2(a) PCT).

Re Item VIII

Certain observations on the international application

The term "substantially" used in claims 15 and 16 is vague and unclear and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claims unclear (Article 6 PCT).